

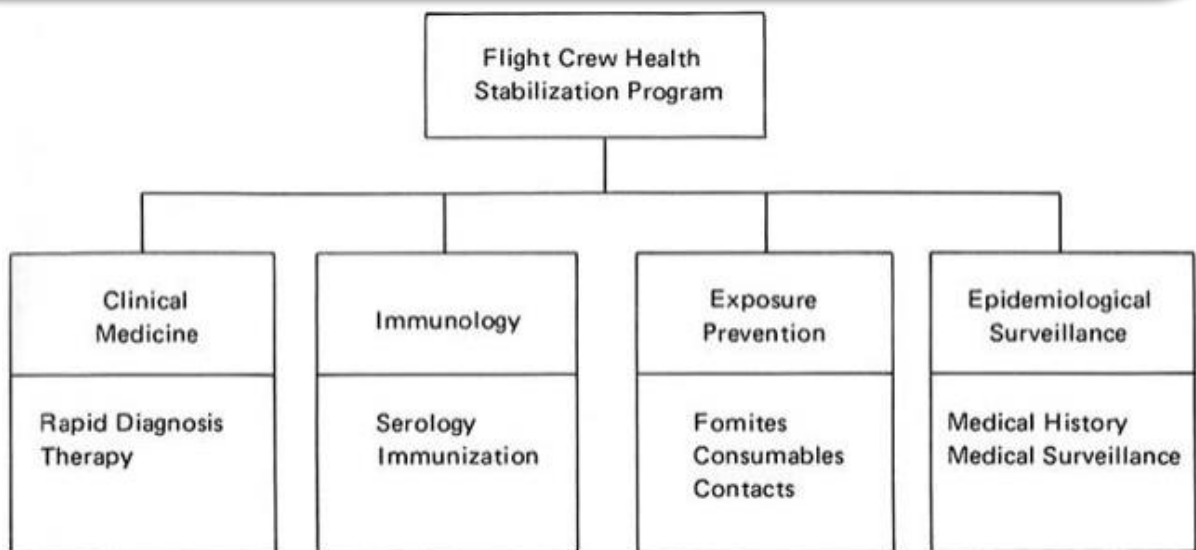


## Overview

### Health Stabilization Program (HSP)

#### Executive Summary

A comprehensive Health Stabilization Program (HSP) is needed for all spaceflight missions to reduce infections pre-flight and prevent subsequent symptoms in-flight. Among other considerations, the increased incidence of infectious diseases in-flight requires more resources be sent up with the crew for treatment and results in decreased crew performance. A HSP has been implemented since the Apollo 14 mission and has led to substantial mission success. The two biggest components of the HSP include pre-flight immunizations and quarantine. Through a combination of these two factors, in-flight infectious diseases (especially upper respiratory and enteric infections) can be mostly mitigated. Current NASA/JSC protocol mandates the HSP begin 14 days before launch. If the crewmembers will not be in space for a considerable amount of time (e.g. transfer missions less than 1 day), an extensive HSP may not be as critical when compared to a longer mission (e.g. Shuttle- or ISS-type missions). However, physical contact between non-HSP and HSP crewmembers must be considered. The HSP can only be successful if there is full participation by all in-flight physical contacts of the crewmembers.



#### Requirements Overview:

##### NASA-STD-3001 Vol. 1

#### 4.4.2.3 Health Stabilization Program

- A Health Stabilization Program (HSP) that includes screening and monitoring shall be in place during the preparatory stages of the mission.
- The HSP shall reduce the likelihood of contracting an infectious disease before launch by limiting exposures.
- Pre-flight immunizations against infectious diseases shall be employed.

## NASA Office of the Chief Health & Medical Officer (OCHMO)

This Technical Brief is derived from NASA-STD-3001 and is for reference only.

It does not supersede or waive existing Agency, Program, or Contract requirements.



## Background

### *Pre- and post-implementation of an HSP in Apollo missions*

- Infectious diseases significantly impacted pre-flight and in-flight phases of Apollo missions 9 – 13. After the implementation of a flight crew HSP (FCHSP), a noticeable reduction in illness incidence occurred:

Mission	Illness	Number of crewmen involved	Mission Phase
Before Implementation of FCHSP			
Apollo 7	Upper respiratory infection	3	Preflight, inflight
8	Viral gastroenteritis	3	Preflight, inflight
9	Upper respiratory infection	3	Preflight
10	Upper respiratory infection	2	Preflight
11	None	-	-
12	Skin infection	2	Inflight
13	Rubella infection	1	Preflight
After implementation of FCHSP			
Apollo 14	-	-	-
15	-	-	-
16	-	-	-
17	Skin infection	1	Preflight

- Prior to the HSP implementation, 57% of Apollo crewmembers experienced some level of infectious illness before flight.
- Since Apollo 14, a HSP (featuring quarantines and vaccinations) has been used before every flight to reduce infectious disease risk. While the risk cannot be reduced to zero, a comprehensive HSP presents a way to significantly reduce hazard

## Reference Documents

SP-368 Biomedical Results of Apollo, Section II: Crew Health and Inflight Monitoring  
Biomedical Results of Skylab, Chapter 7: Analysis of the Skylab Flight Crew Health Stabilization Plan  
SSP 50480-ANX1 Guidelines and Procedures for the Prevention of Infectious Disease Transmission to ISS Crewmembers  
JSC-22538 Flight Crew Health Stabilization Program, Rev. E



## Reference Procedures

### Past and Current HSPs

#### Apollo

- 21-day HSP for prime and backup crew
- Immunizations (table)
- Extensive disease exposure prevention via quarantine
  - Limited exposure to fomites, contaminated consumables, and interpersonal contacts
  - Crewmembers used different equipment
  - Closely controlled living environment – ultra-high efficiency bacterial filters, positive air pressure (outward flow of air only), and controlled food and water intake (including microbiological testing of samples)
  - No exposure to potential carriers (e.g. children, maintenance personnel); contacts restricted to medically approved individuals only (~100 people total)

Disease	Required immunization of Astronaut	Required immunization of Family Members of Astronaut
Diphtheria	Yes	Yes
Pertussis	No	Yes
Tetanus	Yes	Yes
Typhoid	Yes	No
Influenza	Yes	No
Mumps	Yes	Yes
Poliomyelitis	Yes	Yes
Rubella	Yes	Yes
Rubeola	Yes	Yes
Smallpox	Yes	Yes
Yellow fever	Yes	No

#### Skylab

- 21-day pre-flight, 7-day post-flight HSP
- Immunizations similar to Apollo
- Quarantines to minimize crew exposure to infectious diseases
  - Similar to Apollo – positive air pressure,
  - Primary contacts were inspected by a nurse before interaction with crew; interactions with non-primary contacts were performed via CCTV
  - Food was specially prepared for the crew
  - Additional space for isolation of an ill crewmember
- Limitations were set on the number of primary contacts
  - Cited as the change that impacted the incidence of disease most

#### ISS

- 14-day pre-flight HSP
- Countermeasures in place: crew and contact education; hand & respiratory hygiene; physical separation; PPE; immunizations (similar to Apollo); medical screening of contacts by a physician before crew interaction; and, avoiding tasks with a high risk of infectious disease acquisition
- Operating groups and personal contacts are allowed to have close crew contact, but special guests and VIPs must stay >1.5 meters away
- Personal contacts are limited to 2-3 people or family members (with exceptions)
  - They may be isolated prior to crew contact, depending on when they arrive at the site



## Application Notes

### *Considerations when implementing an HSP*

- Back-up crewmembers, in addition to the prime crew, should be considered in the HSP in case of crew swaps
- The incubation period for almost all non-vaccine, preventable infectious diseases is  $\leq 3$  weeks
  - To ensure minimized risk, isolation/quarantine periods should include at least the 2 weeks prior to launch
- Access to quarantine facilities should only be for mission-required purposes
- Pertinent modes of transmission for infectious disease prevention include contact, droplet ( $>5\mu\text{m}$ ), airborne ( $\leq 5\mu\text{m}$ ), and blood-borne
- Primary contacts (PCs)
  - Any individual who requires access to the quarantine facility for mission-related purposes – may or may not come into contact with the crew
  - Includes operational groups, crew family / personal contacts, special guests & VIPs, aircrew, and staff with access to the crew quarters/vehicle
  - All PCs should be medically screened by physician or medical personnel via questionnaires and physical exams before contact with the crew
- Current immunizations required for crew and PCs
  - Measles, mumps, rubella, diphtheria, pertussis, polio, varicella, and hepatitis A & B
  - Influenza vaccination is not a requirement; if the PC has not received, then they have to wear PPE